Notice No.5

Rules and Regulations for the Classification of Ships, July 2017

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Please note that corrigenda amends to paragraphs, Tables and Figures are not shown in their entirety.

Issue date: January 2018

Amendments to	Effective date	IACS/IMO implementation (if applicable)
Part 3, Chapter 1, Sections 5 & 7	1 July 2018	1 July 2018
Part 3, Chapter 13, Sections 7, 8, 9, 10, 11 & 12	1 July 2018	1 July 2018
Part 4, Chapter 3, Section 7	1 July 2018	N/A
Part 7, Chapter 11, Sections 1 & 3	Corrigenda	N/A

Part 3, Chapter 1
General

■ *Section 5*
Information required

5.3 Plans to be supplied to the ship

(Part only shown)

5.3.1 A Ship Construction File is to be provided on board ~~of~~ the ship containing information to facilitate inspection~~./.~~/survey, repair and maintenance. As a minimum it is to include the following documentation and plans:

(n) The towing and mooring arrangements plan in accordance with *Pt 3, Ch 13, 9.4 Towing and mooring arrangements plan* is to be provided ~~on board~~ for the guidance of the Master. ~~The information provided on the plan is to include the following in respect of each shipboard fitting:~~

- ~~Location on the ship.~~
- ~~Fitting type.~~
- ~~Safe working load (SWL).~~
- ~~Purpose of fitting (mooring/harbour towing/escort towing).~~
- ~~Manner of applying towing or mooring line load, including limiting fleet angles.~~
- ~~Strength of each mooring line.~~
- ~~The number of mooring lines supplied on board the ship.~~

~~This~~ The information contained in the towing and mooring arrangement plan is also to be incorporated into the pilot card in order to provide the pilot with the necessary information on harbour/escorting operations.

■ *Section 7*
Equipment Number

7.1 Calculation of Equipment Number

7.1.2 In the calculation of *H* ~~and *A*~~, sheer and trim are to be ignored. Where there is a local discontinuity in the upper deck, *H* is to be measured from a notional deckline.

7.1.4 Screens and bulwarks more than 1,5 m in height are to be regarded as parts of houses when determining *H* and *A*. Where a screen or bulwark is of varying height, the portion to be included is to be that length the height of which exceeds 1,5 m. The height of the hatch coamings and that of any deck cargo, such as containers, may be disregarded when determining *H* and *A*.

7.1.5 The Equipment Number for tugs is to be calculated as follows:

$$EquipmentNumber = \Delta^{\frac{2}{3}} + 2\left(Bf + \sum bh\right) + \frac{A}{10}$$

where

Δ, *B* and *A*	=	are defined in *Pt 3, Ch 1, 7.1 Calculation of Equipment Number 7.1.1*
b	=	breadth, in metres, of the widest superstructure or deckhouse on each tier~~.~~ having a breadth greater than $\frac{B}{4}$
f	=	freeboard amidships, in metres, from the summer load waterline
h	=	the height, in metres, of each tier of superstructure or deckhouse at side having a breadth of $\frac{B}{4}$ or greater. In the calculation of *h*, sheer and trim are to be ignored.

7.1.6 In the case of dredgers having normal ship shape underwater hull, bucket ladders and gallows are not to be included in the Equipment Number calculations. If the dredger has an unusual underwater hull design or has a limited service area, the anchoring equipment needs to be specially considered.

7.1.7 The Equipment Number formulae for anchoring equipment as given in this Section are based on an assumed maximum current speed of 2,5 m/s, maximum wind speed of 25 m/s and a minimum scope of chain cable of 6, the scope being the ratio between length of chain paid out and water depth. For ships with a Rule length, L, greater than 135 m, the required anchoring equipment is also considered adequate for a maximum current speed of 1,54 m/s, a maximum wind speed of 11 m/s and waves with maximum significant height of 2 m.

Part 3, Chapter 13
Ship Control Systems

■ *Section 7*
Equipment

7.1 General

(Part only shown)

Table 13.7.1 Equipment requirements

Ship type	Service	Required equipment
Cargo ships, bulk carriers, tankers, ferries, dredgers, etc. (*see Pt 3, Ch 13, 1.1 Application 1.1.2*)	Unrestricted service	~~(1) *See Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1* and *Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1*, using N_C~~ (1) The equipment is to be selected from the following sub-Sections as appropriate, using N_C Anchor and chain cables — *See Table 13.7.2 Equipment - Bower anchors and chain cables* Mooring lines — *See Pt 3, Ch 13, 7.5 Mooring lines (Equipment Number ≤ 2000)* or *Pt 3, Ch 13, 7.6 Mooring lines (Equipment number > 2000)* as appropriate. Towing line — *See Pt 3, Ch 13, 7.8 Towline and towing arrangement*
Ferries	Certain restricted ~~Services~~ services, *see Pt 1, Ch 2, 2.3 Class notations (hull) 2.3.9*	~~(2) *See Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1* and *Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1*, using N_C and N_A as appropriate~~ (2) As per item (1), using N_C and N_A as appropriate Mass of bower anchor — N_A = one grade below N_C Chain cable length and diameter — N_A = one grade below N_C Stream anchor may be omitted
~~Ferries~~	Specified coastal service, *see Pt 1, Ch 2, 2.3 Class notations (hull) 2.3.8*	(3) As per item (2), ~~also~~ and ~~Anchor chains~~ Chain cables — ~~Where L < 30 m, may be replaced with wire ropes of equal minimum breaking strength which should:~~ ~~(a) have a length 1,5 times that for chain cable required by *Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1* and~~ ~~(b) have a length of Grade U2/U1 chain cable not less than 12,5 m between anchor and wire rope.~~ ~~Where 30 m ≤ L ≤ 40 m one chain cable may be replaced with wire rope meeting the requirements of L > 40 m. The other may be replaced with wire rope meeting the requirements of L < 30 m.~~ Where L < 40 m, wire ropes may be used in place of chain cables when the requirements specified under *Pt 3, Ch 13, 7.4 Chain cables and chain locker 7.4.7 and Pt 3, Ch 13, 7.4 Chain cables and chain locker 7.4.9* are complied with. Where 40 m ~~<~~ ≤ L ≤ 90 m, ~~both~~ chain cables may be replaced with wire rope of equal minimum breaking strength when ~~which should~~ : (a) ~~have a length 1,5 times that for chain cable required by *Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1* and~~ the requirements specified for L < 40 m are complied with and

			(b) have a minimum mass per unit length of 30% that of Grade U2 chain cable required *by Table 13.7.2 Equipment - Bower anchors and chain cables*. ~~by *Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1* and~~ ~~(c) have a length of Grade U2/U1 chain cable not less than 12,5 m between anchor and wire rope.~~
Dredging and reclamation craft	Extended protected waters service, *see Pt 1, Ch 2, 2.3 Class notations (hull) 2.3.7*	(4) ~~*See Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1* and *Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1*,~~ As per item (1), using N_C and N_A as appropriate $N_A = N_C$ reduced by two grades, except for stream anchors~~,~~ or mooring lines Stream anchor – not required if ship fitted with positioning spuds	
	Protected waters service, *see Pt 1, Ch 2, 2.3 Class notations (hull) 2.3.6*	(5) ~~*See Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1 and Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1*~~ As per item (1),using N_C and N_A as appropriate Mass of bower anchor $N_A = 0{,}5N_C$ Chain cable diameter $N_A = 0{,}5N_C$ Bower anchors powered ships – two anchors Bower anchors unpowered (manned) ships – one anchor Chain cable length – greater of $2L$ m or $10{,}0T_D$ m, but need not exceed requirements for an ordinary cargo ship with anchors of the same mass Mooring lines – as required for N_C Wire ropes – may be substituted for chain cable on bower anchors if breaking strength ≥1,5 times that of the chain cable	
Trawlers, stern trawlers, fishing vessels	Unrestricted service	(6) ~~*See Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1*~~, and ~~Notes to *Table Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1* using N_G~~ The equipment for fishing vessels is to be selected from *Pt 3, Ch 13, Table 13.7.4 Equipment for fishing vessels* using N_C. ~~Anchor chains~~ Chain cables ~~Where L < 30 m, may be replaced with wire ropes of equal strength. Where 30 m ≤ L ≤ 40 m, one chain cable may be replaced with wire rope of equal strength provided normal chain cable maintained for the second line.~~ ~~Wire ropes of trawl winches complying with above may be used as anchor cables. Wire ropes substituted for anchor chains should~~ ~~(a) have a length 1,5 times that for chain cable required by *Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1* and~~ ~~(b) have a length Grade U2/U1 of chain not less than 12,5 m between anchor and wire rope.~~ Where L < 40 m, wire ropes (including those fitted to trawl winches) may be used in place of chain cables when the requirements specified under *Pt 3, Ch 13, 7.4 Chain cables and chain locker, 7.4.7 and Pt 3, Ch 13, 7.4 Chain cables and chain locker 7.4.9* are complied with. Hawsers and warps – Sufficient in number and strength for proper working of the ship	

Tugs	Unrestricted and restricted service	(7) ~~*See* Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1 and Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1~~ As per item (1) using N_C except as stated below Stream anchor – not required Towlines – adequate for tug's maximum bollard pull with factor of safety ≥ 2,0
	Service restricted, *see Pt 1, Ch 2, 2.3 Class notations (hull) 2.3.7* to *Pt 1, Ch 2, 2.3 Class notations (hull) 2.3.10*	(8) ~~*See Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1* and *Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length7.6.1*~~ As per item (1) using N_C
		Mass of bower anchor – reduced to correspond to two Equipment Letters below that required for N_C Chain cable diameter – reduced to correspond to two Equipment Letters below that required for N_C Anchor chains – As item (3) in this Table
	Protected waters service, *See Pt 1, Ch 2, 2.3 Class notations (hull) 2.3.6*	(9) ~~*See Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1* and *Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1*~~ As per item (1) using N_A Mass of bower anchor – $N_A = 0,5N_C$ Chain cable diameter – $N_A = 0,5N_C$ Chain cable length – 0,5 times length required by N_A Where $N_C < 90$, the requirements for anchors and chain cable will be specially considered Anchor chains – As item (3) in this Table
Offshore supply ships	Unrestricted service	(10) ~~*See Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1* and *Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1*~~, As per item (1), using N_C Chain cable length and diameter – increased to correspond to two Equipment and diameter Letters above that required for N_C. Need not be applied for ships with **DP(AAA), DP(AA)** or **DP(AM)** notations
Manned barges and pontoons	Service restricted, *see Pt 1, Ch 2, 2.3 Class notations (hull) 2.3.7 to Pt 1, Ch 2, 2.3 Class notations (hull) 2.3.10*	(11) As item (4) in this Table
Unmanned barges and pontoons	Unrestricted service, or service restricted, *see Pt 1, Ch 2, 2.3 Class notations (hull) 2.3.7* to *Pt 1, Ch 2, 2.3 Class notations (hull) 2.3.10*TT	(12) ~~*See Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1* and *Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length 7.6.1*~~, As per item (1), using N_C and N_A as appropriate. Anchors – $L < 30$ m, no anchor need be carried Anchors – $L \geq 30$ m, one anchor to be fitted Anchor cable length – greater of 40 m or 2L m

7.1.6 The anchoring equipment required herewith is intended for temporary mooring of a ship within a harbour or sheltered areas when the ship is awaiting berth, tide, etc. It is designed to hold a ship only in good holding ground conditions to avoid dragging of the anchor. In poor holding ground, the holding power of the anchors would be significantly reduced.

7.1.7 It is assumed that under normal circumstances a ship uses only one bower anchor and chain cable at a time.

7.1.8 The bower anchors and stream anchor, if any, are to be connected to their cables and positioned on board ready for use.

7.2 Anchors

7.2.5 When stocked bower or stream anchors are to be used, the mass ~~`ex-stock'~~ excluding the stock is to be not less than 80 per cent of the mass given in *Table 13.7.2 Equipment - Bower anchors and chain cables* for ordinary stockless bower anchors. The mass of the stock is to be 25 per cent of the total mass of the anchor, including the shackle, etc. but excluding the stock.

7.2.6 It is recommended that anchor lashings, e.g. a 'devil's claw', be fitted to hold the anchor tight against the hull or the anchor pocket. Anchor lashings are to be designed to resist at least a load corresponding to twice the anchor mass plus 10 m of cable without exceeding 40 per cent of the yield strength of the material.

7.3 High holding power anchors

7.3.2 Anchor designs for which approval is sought as high holding power anchors are to be tested at sea to show that they have holding powers of at least twice those of approved standard stockless anchors of the same mass. For holding power test requirements relating to high holding power anchors, *see Ch 10, 1.3 Anchor holding power tests for HHP and SHHP anchors* of the *Rules for the Manufacture, Testing and Certification of Materials, July 2017*.

~~7.3.3 If approval is sought for a range of sizes, then at least two sizes are to be tested. The smaller of the two anchors is to have a mass not less than one-tenth of that of the larger anchor, and the larger of the two anchors tested is to have a mass not less than one-tenth of that of the largest anchor for which approval is sought.~~

7.3.3 The anchor is to be suitable for the ship's use and is not to require prior adjustment or special placement on the sea bottom.

~~7.3.5 The test should normally be carried out from a tug or other suitable vessel, and the pull measured by dynamometer or derived from recently verified curves of tug rev/min against bollard pull. The tests are to be conducted on no fewer than three different types of bottom, which should normally be soft mud or silt, sand or gravel, and hard clay or similarly compacted material. A scope of 10 is recommended for the anchor cable, but in no case should a scope of less than six be used. The same scope is to be used for the anchor for which approval is sought and the anchor that is being used for comparison purposes.~~

7.4 Chain cables and chain locker

7.4.2 Chain cables may be of mild steel, special quality steel or extra quality steel in accordance with the requirements of *Ch 10 Equipment for Mooring and Anchoring* of the *Rules for the Manufacture, Testing and Certification of Materials, July 2017* ~~*Chapter 10 of the Rules for Materials*~~ and are to be graded in accordance with *Table 13.7.5 Chain cable steel grades.* The total length of chain cable given in *Table 13.7.2 Equipment - Bower anchors and chain cables* is to be divided in approximately equal parts between the two bower anchors.

7.4.4 Where stream anchors are used in association with chain cable, this cable may be either stud link or short link. Also for Equipment Number ≤ 90, short link chain cables may be used for bower anchors as an alternative to stud link chain cables.

7.4.6 Where Owners require equipment for anchoring at depths greater than 82,5 m~~, it is their responsibility to specify the appropriate total length of the chain cable required for this purpose. In such cases, consideration can be given to dividing the chain cable into two unequal lengths.~~ and up to 120 m, the recommendations specified in *Pt 3, Ch 13, 10 Anchoring equipment in deep and unsheltered water* shall be complied with.

7.4.7 Wire rope may be used in place of chain cable for bower anchors on ships with Rule length *L* less than 40 m when subjected to the following conditions:

(a) The length of the wire rope is to be equal to 1,5 times the corresponding tabular length of chain cable specified by *Table 13.7.2 Equipment - Bower anchors and chain cables* or *Table 13.7.4 Equipment for fishing vessels* as appropriate.

(b) The breaking strength is to be equal to that of tabular chain cable of Grade U1.

7.4.8 Wire ropes or chain cable are to be used for stream anchors as specified by *Table 13.7.3 Equipment - Stream anchors, stream wires, towlines and mooring lines*.

7.4.9 When wire ropes are used instead of chain cable in accordance with *Pt 3, Ch 13, 7.4 Chain cables and chain locker 7.4.7 or Pt 3, Ch 13, 7.4 Chain cables and chain locker 7.4.8*:

(a) A short length of chain cable is to be fitted between the wire rope and bower or stream anchor having a length of 12,5 m or the distance between the anchor in the stowed position and the winch, whichever is less.

(b) All surfaces being in contact with the wire need to be rounded with a radius of not less than 10 times the wire rope diameter (including stem).

7.4.10 Where wire rope is used in lieu of chain cable for anchoring, galvanised wire rope with an independent wire core in accordance with *Ch 10, 6 Steel wire ropes* of the *Rules for the Manufacture, Testing and Certification of Materials, July 2017* is to be used. Wire rope terminal fittings are to comply with an acceptable code or standard. The strength of terminations, connecting fittings, shackles or links is not to be less than that of the anchor line.

7.4.11 The chain locker is to be of adequate capacity and depth to provide an easy direct lead of the cables through the chain pipes and facilitate self-stowing of the cables. The chain locker is to be provided with an internal division so that the port and starboard chain cables can be separately stowed.

7.4.12 The chain locker boundaries are to be watertight up to the weather deck. Where the means of access to the chain locker is located below the weather deck, the access cover and its securing arrangement in general are to be in accordance with recognised standards for watertight manhole with bolted covers (e.g. ISO 5894 Ships and marine technology – Manholes with bolted covers). Butterfly nuts and/or hinged bolts are prohibited as the securing mechanism for the access cover.

7.4.13 The chain locker is to be provided with adequate drainage facilities.

Existing sub-Sections 7.5 and 7.6 have been deleted in their entirety.

7.5 Mooring lines (Equipment Number $\leq$ 2000)

7.5.1 It is recommended that the minimum breaking strength, length and number of mooring lines provided on board ships with equipment number of less than or equal to 2000 are not to be less than that specified in *Table 13.7.3 Equipment – Stream anchors, stream wires, towlines and mooring lines*. The Equipment Number is to be calculated in accordance with *Pt 3, Ch 1, 7.1 Calculation of Equipment Number.* Deck cargo as given by the loading manual is to be included in the determination of side-projected area *A* to be used in this sub-Section including the equipment number calculations.

7.5.2 It is the Owners responsibility to ensure the adequacy of the mooring equipment. The equipment should be verified through carrying out ship specific mooring calculations. The mooring calculations are to be representative of the anticipated mooring configurations, as well as accounting for operational and environmental considerations. This section details minimum recommendations only, and where the calculations provide a lesser specification it is recommended that they be increased in accordance with this section.

7.5.3 For ships having the ratio of side projected area *A* and equipment number as defined in *Pt 3, Ch 1, 7.1 Calculation of Equipment Number* greater than 0,9, the following number of lines is to be added to the number of mooring lines as given by the *Table 13.7.3 Equipment – Stream anchors, stream wires, towlines and mooring lines*:

(a) One line where $0{,}9 < \frac{A}{\text{Equipment Number}} \leq 1{,}1$,

(b) Two lines where $1{,}1 < \frac{A}{\text{Equipment Number}} \leq 1{,}2$,

(c) Three lines where $1{,}2 < \frac{A}{\text{Equipment Number}}$

7.5.4 It is permitted to reduce the individual mooring line lengths specified by *Table 13.7.3 Equipment – Stream anchors, stream wires, towlines and mooring lines* by up to 7 per cent provided the total length of mooring lines is not less than the total length, if all the lines were of equal given lengths.

7.6 Mooring lines (Equipment Number $>$ 2000)

7.6.1 The recommended minimum breaking strength, length and number of mooring lines for ships with equipment number greater than 2000, calculated in accordance with *Pt 3, Ch 1, 7.1 Calculation of Equipment Number* are provided in this sub-Section. Deck cargo as given by the Loading Manual is to be included in the determination of side-projected area *A* to be used in this sub-Section including the equipment number calculations.

7.6.2 It is the Owners responsibility to ensure the adequacy of the mooring equipment. The equipment should be verified through carrying out ship specific mooring calculations. The mooring calculations are to be representative of the anticipated mooring configurations, as well as accounting for operational and environmental considerations. This section details minimum recommendations only, and where the calculations provide a lesser specification it is recommended that they be increased in accordance with this section. A typical mooring arrangement is indicated in *Figure 13.7.1 Typical mooring arrangement* and the following is defined with respect to mooring lines.

(a) Breast line: A mooring line that is deployed perpendicular to the ship, restraining the ship in the off-berth direction.
(b) Spring line: A mooring line that is deployed almost parallel to the ship, restraining the ship in the fore or aft direction.
(c) Head/stern line: A mooring line that is oriented between longitudinal and transverse direction, restraining the ship in the off-berth and in the fore or aft direction. The amount of restraint in fore or aft and off-berth direction depends on the line angle relative to these directions.

7.6.3 The strength of mooring lines and the number of head, stern, and breast lines for ships with an equipment number > 2000 are based on the side-projected area A_1. Side projected area A_1 should be calculated similar to the side-projected area *A* according to *Pt 3, Ch 1, 7.1 Calculation of Equipment Number* but considering the following conditions:

(a) For oil tankers, chemical tankers, bulk carriers, and ore carriers, the lightest ballast draft is to be considered for the calculation of the side-projected area A_1. For other ships the lightest draft of usual loading conditions is to be considered if the ratio of the freeboard in the lightest draft and the full load condition is equal to or above two. Usual loading conditions mean loading conditions as given by the trim and stability booklet that are to be expected to regularly occur during operation and, in particular, excluding light weight conditions, propeller inspection conditions, etc.
(b) Wind shielding of the pier can be considered for the calculation of the side-projected area A_1 unless the ship is intended to be regularly moored to jetty type piers. A height of the pier surface of 3 m above the waterline can be assumed, i.e. the lower part of the side projected area with a height of 3 m above the waterline for the considered loading condition can be disregarded for the calculation of the side-projected area A_1.
(c) Deck cargo as given by the Loading Manual is to be included for the determination of side-projected area A_1. Deck cargo need not be considered if the usual light draft condition without cargo on deck generates a larger side-projected area A_1 than the full load condition with cargo on deck. The larger of both side-projected areas should be chosen as side-projected area A_1.

7.6.4 The mooring lines specified are based on a maximum current speed of 1,0 m/s and the following maximum wind speed V_w:

V_w = 25,0 − 0,002(A_1 − 2000) m/s for passenger ships, ferries and car carriers with 2000 m^2 < A_1 ≤ 4000 m^2
= 21,0 m/s for passenger ships, ferries and car carriers with A_1 > 4000 m^2
= 25,0 m/s for other ships

7.6.5 The maximum wind speed V_w is representative of the mean wind speed over a 30 second period from any direction and at a height of 10 m above the ground. The current speed considered is a representative of the maximum current speed acting on bow or stern (±10°) at a depth of one-half of the mean draft. Furthermore, it is considered that the ships are moored to solid piers that provide shielding against cross currents.

7.6.6 Additional loads caused by higher wind or current speeds, cross currents, additional wave loads or reduced shielding from non-solid piers, for example, are to be specially considered. Consideration is also to be given to the fact that unfavourable mooring layouts can significantly increase the loads on individual mooring lines.

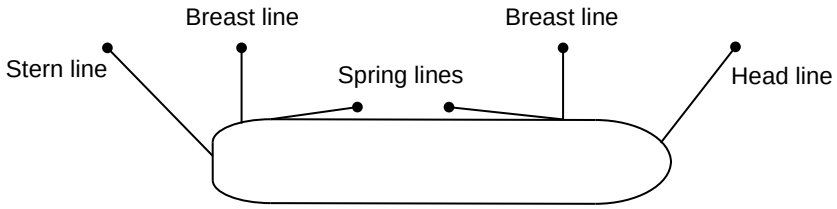

Figure 13.7.1 Typical mooring arrangement

7.6.7 The minimum breaking strength, in kN, of the mooring lines (MBL) is to be taken as:

$$\text{MBL} = 0{,}1 \times A_1 + 350$$

where

A_1 = Side projected area as defined by *Pt 3, Ch 13, 7.6 Mooring lines (Equipment Number > 2000) 7.6.3*

7.6.8 The minimum breaking strength may be limited to 1275 kN (130 tonnes). However, in these cases, the moorings are not to be considered sufficient for the environmental conditions given by *Pt 3, Ch 13, 7.6 Mooring lines (Equipment Number > 2000) 7.6.4*. For these ships, the acceptable wind speed V_w^*, in m/s, to be calculated as follows:

$$V_w^* = V_w \times \sqrt{\frac{\text{MBL}^*}{\text{MBL}}}$$

where

V_w = wind speed as per *Pt 3, Ch 13, 7.6 Mooring lines (Equipment Number > 2000) 7.6.4*
MBL* = the breaking strength of the mooring lines intended to be supplied
MBL = required breaking strength provided by *Pt 3, Ch 13, 7.6 Mooring lines (Equipment number > 2000) 7.6.7*

However, the intended minimum breaking strength MBL* is not to be taken less than that corresponding to an acceptable wind speed of 21 m/s:

$$\text{MBL}^* \geq \left(\frac{21}{V_w}\right)^2 \times \text{MBL}$$

7.6.9 If the mooring lines are intended to be supplied for an acceptable wind speed V_w^* , higher than V_w as per *Pt 3, Ch 13, 7.6 Mooring lines (Equipment Number > 2000) 7.6.4*, the minimum breaking strength to be taken as:

$$\text{MBL}^* = \left(\frac{V_w^*}{V_w}\right)^2 \times \text{MBL}$$

where

MBL = required breaking strength provided by *Pt 3, Ch 13, 7.6 Mooring lines (Equipment Number > 2000) 7.6.7*

7.6.10 The total number of head, stern and breast lines is specified as:

$$n = 8{,}3 \times 10^{-4} \times A_1 + 6$$

where

A_1 = side projected area as defined by *Pt 3, Ch 13, 7.6 Mooring lines (Equipment Number > 2000) 7.6.3*

However, for oil tankers, chemical tankers, bulk carriers and ore carriers the total number of head, stern and breast lines is to be taken as:

$$n = 8{,}3 \times 10^{-4} \times A_1 + 4$$

The total number of head, stern and breast lines is to be rounded to the nearest whole number. The number may be increased or decreased in conjunction with an adjustment to the strength of the lines. The adjusted strength, MBL*, is to be taken as:

$$\text{MBL}^* = 1{,}2 \times \text{MBL} \times \frac{n}{n^*} \leq \text{MBL, for increased number of lines}$$

$$\mathrm{MBL}^* = \mathrm{MBL} \times \frac{n}{n^*}, \text{for reduced number of lines}$$

where

n = number of lines for the considered ship type as calculated by the above formula without rounding
n^* = increased or decreased total number of head, stern and breast lines.

Vice versa, the strength of head, stern and breast lines may be increased or decreased in conjunction with an adjustment to the number of lines.

7.6.11 The total number of spring lines is to be taken not less than:

Two lines where EN < 5000,
Four lines where EN ≥ 5000.

The strength of spring lines is to be the same as that of the head, stern and breast lines. If the number of head, stern and breast lines is increased in conjunction with an adjustment to the strength of the lines, then the number of spring lines are to be likewise increased, but rounded up to the nearest even number.

7.6.12 The length of mooring lines is to be taken as 200 m. It is permitted to reduce the length of individual mooring line by up to 7 per cent provided that the total length of mooring lines is not less than the total length, if all the lines were of equal given lengths.

7.7 Mooring Arrangement and winches

7.7.1 The recommendations with respect to the mooring arrangement and mooring winches are provided by this sub-Section.

7.7.2 Mooring lines in the same service (e.g. breast lines) are to be of the same characteristics in terms of strength and elasticity.

7.7.3 As far as possible, a sufficient number of mooring winches is to be fitted so as to allow all mooring lines to be belayed on winches. This allows for an efficient distribution of the load to all mooring lines in the same service and for the mooring lines to shed the load before they break. If the mooring arrangement is designed such that mooring lines are partly to be belayed on bitts or bollards, it is to be understood that these lines may not be as effective as the mooring lines belayed on winches.

7.7.4 In the case of ships with Rule length *L* greater than 90 m, all ropes having breaking strengths in excess of 736,0 kN and used in normal mooring operations are to be handled by, and stored on, suitably designed winches. Alternative methods of storing shall give due consideration to the difficulties experienced in manually handling ropes having breaking strengths in excess of 490,0 kN.

7.7.5 The mooring winch is to be fitted with brakes, the holding capacity of which is sufficient to prevent unreeling of the mooring line when the rope tension is equal to 80 per cent of the minimum breaking strength of the rope as fitted on the first layer. The winch is to be fitted with brakes that will allow for the reliable setting of the brake rendering load.

7.7.6 For powered winches the maximum hauling tension which can be applied to the mooring line (the reeled first layer) is to be not less than 2/9, nor to be more than, 1/3, of the rope's minimum breaking strength. For automatic winches these figures apply when the winch is set to the maximum power with automatic control.

7.7.7 For powered winches on automatic control, the rendering tension which the winch can exert on the mooring line (the reeled first layer) is not to exceed 1,5 times, nor be less than 1,05 times, the hauling tension for that particular power setting of the winch. The winch is to be marked with the range of rope strengths for which it is designed.

7.7.8 Mooring lines are to have a straight lead from the mooring drum to the fairlead as far as practicable.

7.7.9 When a mooring line changes direction, the contact surface on the fitting shall have a large radius so as to minimise the wear experienced by the mooring lines. Recommendations from the rope manufacturer for the intended rope type are also to be complied with.

7.8 Towline and towing arrangement

7.8.1 The recommended towlines are given in *Table 13.7.3 Equipment – Stream anchors, stream wires, towlines and mooring lines* and are intended as ship's own towline, for being towed by a tug or another ship. This sub-Section also provides recommendations with respect to the towing arrangement.

7.8.2 The equipment number used for the selection of the towline is to be calculated in accordance with *Pt 3, Ch 1, 7.1 Calculation of Equipment Number*. Deck cargo as given by the Loading Manual is to be included in the determination of side-projected area *A* to be used in the equipment number calculations.

7.8.3 Towing lines are to be led through a closed chock. The use of open fairleads with rollers or closed roller fairleads is to be avoided.

7.8.4 For the purpose of towing, it is recommended to provide at least one chock close to centreline of the ship forward and aft. It is also beneficial to provide additional chocks on port and starboard side at the transom and at the bow.

7.8.5 Towing lines are to have a straight lead from the towing bitt or bollard to the chock.

7.8.6 For the purpose of towing, bitts or bollards serving a chock are to be located slightly offset and at a distance of at least 2 m away from the chock, *see Figure 13.7.2 Typical towing arrangement*.

7.8.7 Attention is to be given to the arrangement of the equipment for towing and mooring operations in order to prevent interference of mooring and towing lines as far as practicable. It is beneficial to provide dedicated towing arrangements separate from the mooring equipment.

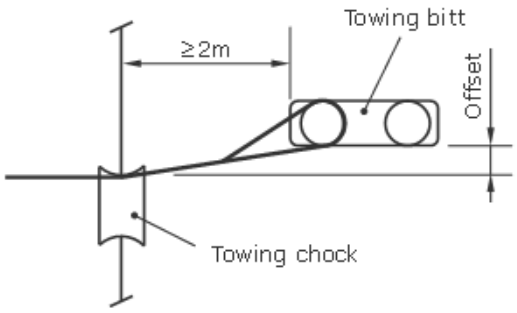

Figure 13.7.2 Typical towing arrangement

7.8.8 For emergency towing arrangements for tankers, reference is made to *Pt 3, Ch 13, 12 Emergency towing arrangements*. For all ships other than tankers, towing arrangements of sufficient strength are to be provided fore and aft, as defined by 'other towing service' in *Pt 3, Ch 13, 9.2 Towing*.

7.9 Mooring and towline construction

7.9.1 Towlines and mooring lines are to be of wire, natural fibre or synthetic fibre construction or of a mixture of wire and fibre. For synthetic fibre ropes it is recommended that lines with reduced risk of recoil (snap-back) be used to mitigate the risk of injuries or fatalities in the case mooring line failure.

7.9.2 Notwithstanding the strength recommendations, no fibre rope shall be less than 20 mm in diameter. For polyamide ropes the minimum breaking strength is to be increased by 20 per cent and for other synthetic ropes by 10 per cent to account for strength loss due to, among other causes, aging and wear.

7.9.3 Wire ropes used for towlines and mooring lines are generally to be of a flexible construction with not less than 144 wires in six strands with seven fibre cores for strengths up to 490 kN, and 222 wires in six strands with one fibre core for strengths exceeding 490 kN. The wires laid round the fibre centre of each strand are to be made up in not less than two layers.

7.9.4 Wire ropes for towlines and mooring lines used in association with mooring winches (on which the rope is stored on the winch drum) are to be of suitable construction.

7.9.5 The towing and mooring lines are to be tested in accordance with *Ch 10, 6 Steel wire ropes* and *Ch 10, 7 Fibre ropes* of the *Rules for the Manufacture, Testing and Certification of Materials, July 2017* for wire ropes and fibre ropes, respectively.

Existing Table 13.7.3 Equipment – Stream anchors, stream wires, towlines and mooring lines has been deleted.

Table 13.7.3 Equipment – Stream anchors, stream wires, towlines and mooring lines

Equipment Number		Stockless stream anchor	Stream wire or chain (*see* Note 1)		Mooring lines (*see* Note 2)			Towline	
Exceeding	Not exceeding	Mass per anchor (kg)	Length (m)	Breaking strength (kN)	No. of mooring lines	Minimum length of each line (m)	Minimum breaking strength (kN)	Minimum length (m)	Minimum breaking strength (kN)
50	70	60	80	64,7	3	80	37	180	98
70	90	80	85	73,5	3	100	40	180	98
90	110	100	85	80	3	110	42	180	98
110	130	120	90	89,2	3	110	48	180	98

130	150	140	90	98,1	3	120	53	180	98
150	175	165	90	107,9	3	120	59	180	98
175	205	190	90	117,7	3	120	64	180	112
205	240				4	120	69	180	129
240	280				4	120	75	180	150
280	320				4	140	80	180	174
320	360				4	140	85	180	207
360	400				4	140	96	180	224
400	450				4	140	107	180	250
450	500				4	140	117	180	277
500	550				4	160	134	190	306
550	600				4	160	143	190	338
600	660				4	160	160	190	370
660	720				4	160	171	190	406
720	780				4	170	187	190	441
780	840				4	170	202	190	479
840	910				4	170	218	190	518
910	980				4	170	235	190	559
980	1060				4	180	250	200	603
1060	1140				4	180	272	200	647
1140	1220				4	180	293	200	691
1220	1300				4	180	309	200	738
1300	1390				4	180	336	200	786
1390	1480				4	180	352	200	836
1480	1570				5	190	352	220	888
1570	1670				5	190	362	220	941
1670	1790				5	190	384	220	1024
1790	1930				5	190	411	220	1109
1930	2080 (*see* Note 2)				5	190	437	220	1168
2080	2230							240	1259
2230	2380							240	1356
2380	2530							240	1453
2530	2700							260	1471
2700	2870							260	1471
2870	3040							260	1471
3040	3210							280	1471
3210	3400							280	1471
3400	3600							280	1471
3600	-							300	1471

Note 1. The rope used for stream wire is to be constructed of not less than 72 wires, made up into six strands.
Note 2. The mooring lines are to be selected only for ships with equipment number less than or equal to 2000.

Existing Table 13.7.4 Trawlers, stern trawlers and fishing vessels has been deleted.

Table 13.7.4 Equipment for fishing vessels

Equipment Number		Stockless bower anchors		Stud link chain cables for bower anchors			Mooring lines		
					Minimum diameter (mm)				
Exceeding	Not exceeding	Number	Mass per anchor (kg)	Total length (m)	Mild steel (Grade U1) *See* Note 1	Special quality steel (Grade U2)	Number	Minimum length of each line (m)	Minimum breaking strength (kN)
30	40	2	80	165	11	-	2	50	29
40	50	2	100	192,5	11	-	2	60	29
50	60	2	120	192,5	12,5	-	2	60	29
60	70	2	140	192,5	12,5	-	2	80	29
70	80	2	160	220	14	12.5	2	100	34
80	90	2	180	220	14	12.5	2	100	36,8
90	100	2	210	220	16	14	2	110	36,8
100	110	2	240	220	16	14	2	110	39
110	120	2	270	247.5	17,5	16	2	110	39
120	130	2	300	247.5	17,5	16	2	110	44
130	140	2	340	275	19	17.5	2	120	44
140	150	2	390	275	19	17.5	2	120	49
150	175	2	480	275	22	19	2	120	54
175	205	2	570	302,5	24	20.5	2	120	59
205	240	2	660	302,5	26	22	2	120	64
240	280	2	780	330	28	24	3	120	71
280	320	2	900	357,5	30	26	3	140	78
320	360	2	1020	357,5	32	28	3	140	85,8
360	400	2	1140	385	34	30	3	140	93
400	450	2	1290	385	36	32	3	140	101
450	500	2	1440	412,5	38	34	3	140	108
500	550	2	1590	412,5	40	34	4	160	113
550	600	2	1740	440	42	36	4	160	118
600	660	2	1920	440	44	38	4	160	123
660	720	2	2100	440	46	40	4	160	127

Note 1. For equipment number ≤ 110, short link chain cables may be considered as an alternative to stud link chain cables.

■ *Section 8*
Windlass design and testing

Existing sub-Section 8.12 has been deleted in its entirety.

Existing Section 9 has been renumbered 11.

■ *Section 9*
Structural requirements associated with towing and mooring

9.1 General

9.1.1 This Section applies to the design and construction of shipboard fittings and supporting structures used for the normal towing and mooring operations. Normal towing means towing operations necessary for manoeuvring in ports and sheltered waters associated with the normal operations of the ship.

9.1.2 The arrangements, equipment and fittings of sufficient safe working load are to be provided to enable the safe conduct of all towing and mooring operations associated with the normal operations of the ship.

9.1.3 For ships, not subject to SOLAS Regulation II-1/3-4 Paragraph 1, but intended to be fitted with equipment for towing by another ship or a tug, e.g. such as to assist the ship in case of emergency as given in SOLAS Regulation II-1/3-4 Paragraph 2, the requirements designated as 'other towing' in this Section are to be applied to the design and construction of those shipboard fittings and supporting hull structures.

9.1.4 This Section is not applicable to the design and construction of shipboard fittings and supporting hull structures used for special towing services such as escort towing, canal transit towing, emergency towing for tankers etc. These requirements are also not applicable to special purpose ships.

9.1.5 Shipboard fittings means bollards and bitts, fairleads, stand rollers, chocks used for the normal mooring of the ship, and the similar components used for normal or other towing of the ship. Any weld or bolt or equivalent device connecting the shipboard fitting to the supporting structure is part of the shipboard fitting. Other components such as capstans, winches, etc. are not covered by this Section.

9.1.6 Supporting hull structures means that part of the ship structure on/in which the shipboard fitting is placed and which is directly submitted to the forces exerted on the shipboard fitting. The supporting hull structure of capstans, winches, etc. used for normal or other towing and mooring operations mentioned above is also to comply with the requirements specified in this Section.

9.2 Towing

9.2.1 The strength of shipboard fittings used for normal towing operations at bow, sides and stern and their supporting hull structures are to comply with the requirements specified in this sub-Section.

9.2.2 Where a ship is equipped with shipboard fittings intended to be used for other towing services, the strength of these fittings and their supporting hull structures are also to comply with the requirements specified.

9.2.3 Shipboard fittings for towing are to be located on stiffeners and/or girders which are part of the deck construction so as to facilitate efficient distribution of the towing load. Other arrangements are acceptable (for chocks in bulwarks, etc.), provided that the strength is confirmed adequate for the intended service.

9.2.4 The design load applied to shipboard fittings and supporting hull structure is not to be less than that given in *Table 13.9.1 Minimum design load for deck fittings and supporting structure - Towing*.

Table 13.9.1 Minimum design load for deck fittings and supporting structure - Towing

Use/Item	Minimum design load (*see* Notes 1 to 3)
Normal towing (harbour/manoeuvring)	1,25 times the intended maximum towing load (e.g. static bollard pull) as indicated on the towing and mooring arrangements plan
Other towing service (SOLAS Regulation II-1/3-4 Paragraph 2)	Minimum breaking strength of the towline
For fittings intended to be used for both normal towing and other towing service	The greater of the specified loads in each case
Note 1. When a safe towing load TOW greater than that determined according to *Pt 3, Ch 13, 9.2 Towing 9.2.12* is requested, then the design load is to be increased in accordance with the appropriate TOW/design load relationship given in this sub-Section. Note 2. Side projected area including that of deck cargoes as given by the loading manual is to be taken into account for selection of towing lines and the loads applied to shipboard fittings and supporting hull structure. Note 3. The increase of the minimum breaking strength for synthetic ropes need not to be taken into account for the loads applied to shipboard fittings and supporting hull structure.	

9.2.5 The design load is to be applied to fittings in all directions that could occur by taking into account the arrangement shown on the towing and mooring arrangements plan. Where the towing line takes a turn at a fitting, the total design load applied to the fitting is equal to the resultant of the design loads acting on the line, *see Figure 13.9.1 Design load applied to fittings*. However, in no case does the design load applied to the fitting need to be greater than twice the design load on the line.

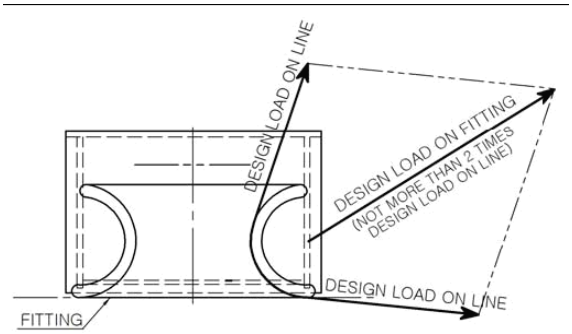

Figure 13.9.1 Design load applied to fittings

9.2.6 Shipboard fittings are to be selected from an acceptable National or International standard and to be based on the following minimum loads.

- For normal towing operations, the intended maximum towing load (e.g. static bollard pull) as indicated on the towing and mooring arrangements plan;
- For other towing service, the minimum breaking strength of the towline in accordance with *Pt 3, Ch 13, 7.8 Towline and towing arrangement* (*see Notes 2 and 3 of Table 13.9.1 Minimum design load for deck fittings and supporting structure - Towing*);
- For fittings intended to be used for both, i.e. normal and other towing operations, the greater of the loads specified in each case is to be used.

9.2.7 Towing bitts (double bollards) are to be chosen for the towing line attached with an eye splice if the industry standard distinguishes between different methods to attach the line, i.e. figure-of eight or eye splice attachment.

9.2.8 When the shipboard fitting is not selected from an accepted industry standard, the strength of the fitting based on net scantlings and its attachment to the ship is to be adequate for the loads specified by the *Table 13.9.1 Minimum design load for deck fittings and supporting structure - Towing* based on the acceptance criteria given in *Pt 3, Ch 13, 9.2 Towing 9.2.10 or 9.2.11* as appropriate. Towing bitts (double bollards) are required to resist the loads caused by the towing line attached with an eye splice. For strength assessment, beam theory or finite element analysis using net scantlings is to be applied, as appropriate. Corrosion additions and wear down allowance is to be added to the net scantlings as defined in this Section.

9.2.9 The net scantlings of the supporting hull structure for the fittings are to be adequate for the loads specified by the *Table 13.9.1 Minimum design load for deck fittings and supporting structure - Towing* based on the acceptance criteria given in by *Pt 3, Ch 13, 9.2 Towing 9.2.10 or 9.2.11 as appropriate*. The reinforced members beneath shipboard fittings are to be effectively arranged for any variation of direction (horizontally and vertically) of the towing forces acting upon the shipboard fittings, *see Figure 13.9.2 Supporting hull structure* for a sample arrangement. Proper alignment of the fitting and its supporting hull structure is to be ensured. The acting point of the towing force on a shipboard fitting is to be taken at the attachment point of a towing line or at a change in its direction. For bollards and bitts the attachment point of the towing line is to be taken not less than 4/5 of the tube height above the base as indicated in *Figure 13.9.2 Supporting hull structure*. Corrosion additions are to be added to the net scantlings as defined in this Section.

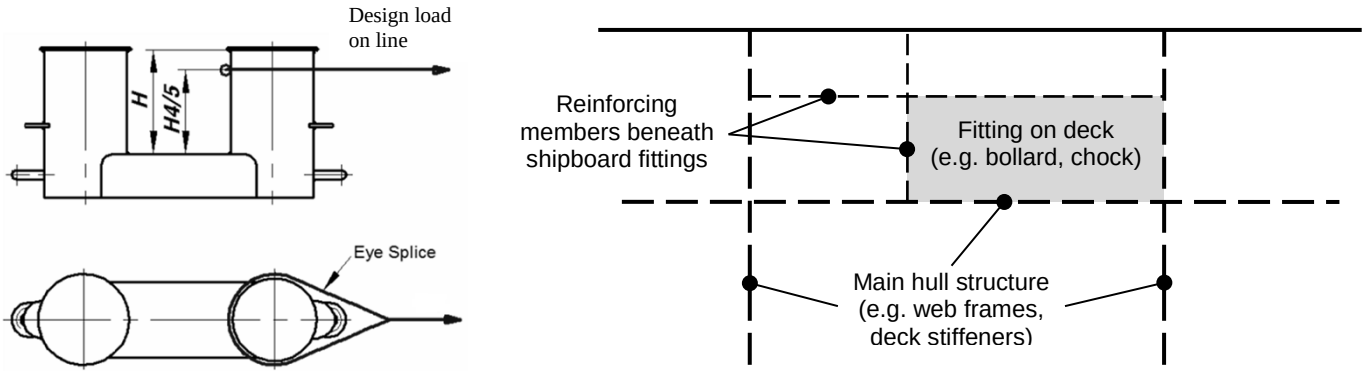

Figure 13.9.2 Supporting hull structure

9.2.10 In the case of strength assessment using beam theory or grillage analysis, the stress within the supporting structure of fittings is not to exceed that given in *Table 13.9.2 Allowable stress within the supporting structure of shipboard fittings*.

9.2.11 For strength calculations by means of finite element analysis, the geometry is to be idealised as realistically as possible. The ratio of element length to width is not to exceed 3. Girders are to be modelled using shell or plane stress elements. Symmetric girder flanges are generally to be modelled by beam or truss elements. At least three elements are to be used across the depth of the girder. In way of small openings in girder webs the web thickness is to be reduced to a mean thickness over the web height. Large openings are to be modelled. Stiffeners are generally to be modelled by using shell, plane stress, or beam elements. Stresses are to be read from the centre of the individual element. For shell elements the stresses are to be evaluated at the mid plane of the element. The equivalent stress within the supporting structure of fittings is not to exceed the specified minimum yield strength of the material.

Table 13.9.2 Allowable stress within the supporting structure of shipboard fittings

	Normal stress, in N/mm^2	Shear stress, in N/mm^2
Allowable stress	$\frac{235}{k}$	$\frac{141}{k}$

where

$k = \frac{235}{\sigma_0}$

σ_0= specified minimum yield strength of the material in N/mm^2

Note: Normal stress is defined as the sum of bending and axial stresses. No stress concentration factors accounted for and as such may need to be considered separately.

9.2.12 The safe towing load (TOW) is the load limit for towing purposes. TOW used is not to exceed 80 per cent of the design loads specified by *Table 13.9.1 Minimum design load for deck fittings and supporting structure - Towing*.

9.2.13 TOW, in tonnes, of each shipboard fitting is to be marked (by weld bead or equivalent) on the deck fittings used for towing. For fittings intended to be used for both, towing and mooring, SWL, in tonnes, according to *Pt 3, Ch 13, 9.3 Mooring* is to be marked in addition to TOW.

9.2.14 The above requirements on TOW apply for the use with no more than one towline line. If not otherwise chosen, for towing bitts (double bollards) TOW is the load limit for a towing line attached with an eye-splice.

9.2.15 The towing and mooring arrangements plan mentioned in *Pt 3, Ch 13, 9.4 Towing and mooring arrangements plan* is to define the method of use of towing lines**.**

9.3 Mooring

9.3.1 The strength of shipboard fittings used for mooring operations and their supporting hull structures as well as the strength of supporting hull structures of winches and capstans are to comply with the requirements specified in this sub-Section.

9.3.2 Shipboard fittings, winches and capstans for mooring are to be located on stiffeners and/or girders which are part of the deck construction so as to facilitate efficient distribution of the mooring load. Other arrangements are acceptable (for chocks in bulwarks, etc.) provided that the strength is confirmed adequate for the service.

9.3.3 The design load applied to shipboard fittings and supporting hull structure is not to be less than that given in *Table 13.9.3 Minimum design load for deck fittings and supporting structure - Mooring*.

9.3.4 The design load is to be applied to fittings in all directions that could occur by taking into account the arrangement shown on the towing and mooring arrangements plan. Where the mooring line takes a turn at a fitting, the total design load applied to the fitting is equal to the resultant of the design loads acting on the line, *see Figure 13.9.1 Design load applied to fittings*. However, in no case does the design load applied to the fitting need to be greater than twice the design load on the line.

Table 13.9.3 Minimum design load for deck fittings and supporting structure - Mooring

Use/Item	Minimum design load (*see* Notes 1 to 3)
Mooring (Fittings and their supporting hull structure)	1,15 times the breaking strength of the mooring lines given in *Pt 3, Ch 13, 7.5 Mooring lines (Equipment Number ≤ 2000)* or *7.6 Mooring lines (Equipment Number > 2000)* as appropriate.
Winches (Supporting hull structure only)	1,25 times the intended maximum brake holding load, where the maximum brake holding load is to be assumed not less than 80% of the minimum breaking strength of the mooring line given in *Pt 3, Ch 13, 7.5 Mooring lines (Equipment Number ≤ 2000)* or *7.6 Mooring lines (Equipment Number > 2000)* as appropriate.
Capstans (Supporting hull structure only)	1,25 times the maximum hauling in force, where hauling in force is defined as the maximum pull of the capstan or 1,25 times the intended maximum brake holding load if that be greater.

Note 1. When a safe working load SWL greater than that determined according to the Rules is requested, the design load is to be increased in accordance with the appropriate SWL/design load relationship given in *Pt 3, Ch 13, 9.3 Mooring 9.3.12*.
Note 2. Side projected area including that of deck cargoes as given by the loading manual is to be taken into account for the selection of mooring lines and the loads applied to shipboard fittings and supporting hull structure.

Note 3. The increase of the minimum breaking strength for synthetic ropes need not to be taken into account for the loads applied to shipboard fittings and supporting hull structure.

9.3.5 Shipboard fittings are to be selected from an acceptable National or International standard and to be based on the minimum breaking strength of the mooring line as given in *Pt 3, Ch 13, 7.5 Mooring lines (Equipment Number ≤ 2000)* or *7.6 Mooring lines (Equipment Number > 2000)*, corresponding to the ship's equipment number (*see Notes 2 and 3, Table 13.9.3 Minimum design load for deck fittings and supporting structure - Mooring*).

9.3.6 Mooring bitts (double bollards) are to be chosen for the mooring line attached in figure-of-eight fashion if the industry standard distinguishes between different methods to attach the line, i.e. figure-of-eight or eye-plice attachment.

9.3.7 When the shipboard fitting is not selected from an accepted industry standard, the strength of the fitting based on net scantlings and its attachment to the ship is to be adequate for the loads specified in *Table 13.9.3 Minimum design load for deck fittings and supporting structure - Mooring* based on the acceptance criteria given in *Pt 3, Ch 13, 9.3 Mooring, 9.3.10 or 9.3.11* as appropriate. Mooring bitts (double bollards) are required to resist the loads caused by the mooring line attached in figure-of-eight fashion. For strength assessment, beam theory or finite element analysis using net scantlings is to be applied, as appropriate. Corrosion additions and wear down allowance is to be added as defined in this Section.

9.3.8 The net scantlings of the supporting hull structure for the fittings are to be adequate for the loads given in *Table 13.9.3 Minimum design load for deck fittings and supporting structure - Mooring* based on the acceptance criteria given in *Pt 3, Ch 13, 9.3 Mooring 9.3.10 and 9.3.11* as appropriate. The arrangement of reinforced members beneath shipboard fittings, winches and capstans is to consider any variation of direction (horizontally and vertically) of the mooring forces acting upon the shipboard fittings, *see Figure 13.9.3 Supporting hull structure* for a sample arrangement. Proper alignment of fitting and supporting hull structure is to be ensured. The acting point of the mooring force on shipboard fittings is to be taken at the attachment point of a mooring line or at a change in its direction. Corrosion additions are to be added to the net scantlings as defined in this Section.

9.3.9 For bollards and bitts the attachment point of the mooring line is to be taken not less than 4/5 of the tube height above the base, *see Figure 13.9.3 Supporting hull structure*. However, if fins are fitted to the bollard tubes to keep the mooring line as low as possible, then the attachment point of the mooring line is to be taken at the location of the fins, *see Figure 13.9.3 Supporting hull structure*.

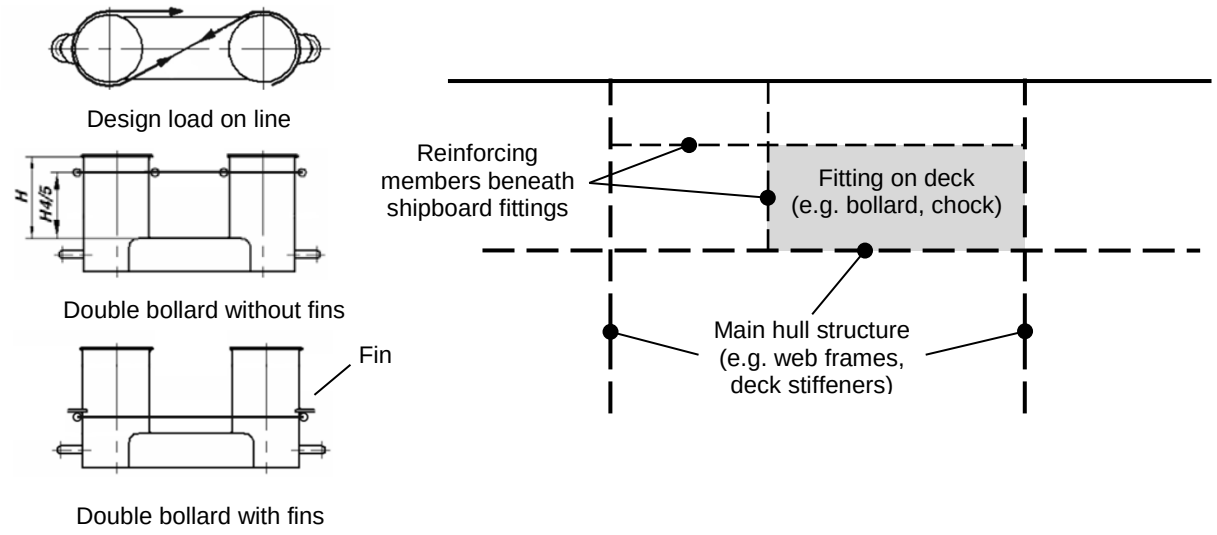

Figure 13.9.3 Supporting hull structure

9.3.10 In the case of strength assessment using beam theory or grillage analysis, the stress within the supporting structure of fittings is not to exceed that given in *Table 13.9.2 Allowable stress within the supporting structure of shipboard fittings*.

9.3.11 For strength calculations by means of finite element analysis, the geometry is to be idealised as realistically as possible. The ratio of element length to width is not to exceed 3. Girders are to be modelled using shell or plane stress elements. Symmetric girder flanges are generally to be modelled by beam or truss elements. At least three elements are to be used across the depth of the girder. In way of small openings in girder webs the web thickness is to be reduced to a mean thickness over the web height. Large openings are to be modelled. Stiffeners are generally to be modelled by using shell, plane stress, or beam elements. Stresses are to be read from the centre of the individual element. For shell elements the stresses are to be evaluated at the mid plane of the element. The equivalent stress within the supporting structure of fittings is not to exceed the specified minimum yield strength of the material.

9.3.12 The Safe Working Load (SWL) is the load limit for mooring purposes. Unless a greater SWL is requested, the SWL assigned shall be the minimum breaking strength of the mooring line given in *Pt 3, Ch 13, 7.5 Mooring lines (Equipment Number ≤ 2000)* and *7.6 Mooring lines (Equipment Number > 2000)*, corresponding to the ship's equipment number (*see* Notes 2 and 3 of *Table 13.9.3 Minimum design load for deck fittings and supporting structure - Mooring*).

9.3.13 The SWL, in tonnes, of each shipboard fitting is to be marked (by weld bead or equivalent) on the deck fittings used for mooring. For fittings intended to be used for both, mooring and towing, the TOW, in tonnes, according to *Pt 3, Ch 13, 9.2 Towing* is to be marked in addition to the SWL.

9.3.14 The above requirements on SWL apply for the use with no more than one mooring line.

9.3.15 The towing and mooring arrangements plan mentioned in *Pt 3, Ch 13, 9.4 Towing and mooring arrangements plan* is to define the method of use of mooring lines.

9.4 Towing and mooring arrangements plan

9.4.1 The SWL and TOW for the intended use for each shipboard fitting is to be noted in the towing and mooring arrangements plan available on board for the guidance of the Master. It is to be noted that TOW is the load limit for towing purpose and SWL that for mooring purpose. If not otherwise chosen, for towing bitts it is to be noted that TOW is the load limit for a towing line attached with an eye splice.

9.4.2 Information provided on the plan is to include in respect for each shipboard fitting:
(a) location on the ship;
(b) fitting type;
(c) SWL/TOW;
(d) purpose (mooring/harbour towing/other towing);
(e) manner of applying towing or mooring line load, including limiting fleet angles.

Note. Item (c) with respect to items (d) and (e), is subject to approval.
Fleet angle is defined as the maximum angle the line deviates from a direction perpendicular to the drum axis of a mooring/towing winch.

Furthermore, information provided on the plan is to include:
(f) the arrangement of mooring lines showing number of lines (*N*);
(g) the minimum breaking strength of each mooring line (MBL);
(h) the acceptable environmental conditions as given in *Pt 3, Ch. 13, 7.6 Mooring lines (Equipment Number > 2000)* for the recommended minimum breaking strength of mooring lines for ships with EN > 2000:
- 30 second mean wind speed from any direction (V_w or V_w^*)
- maximum current speed acting on bow or stern (±10°).

9.4.3 The above information as given *Pt 3, Ch 13, 9.4 Towing and Mooring arrangements plan 9.4.2* is to be incorporated into the pilot card in order to provide the pilot with proper information on harbour and other towing operations.

9.5 Corrosion addition

9.5.1 An allowance for corrosion is to be added to the net thickness derived as indicated below:
- For the supporting hull structure, a corrosion addition of 2 mm is to be added to the net thickness derived.
- For pedestals and foundations on deck which are not part of a fitting according to an accepted industry standard, 2,0 mm.
- For shipboard fittings not selected from an accepted industry standard, 2,0 mm.

9.6 Wear allowance

9.6.1 In addition to the corrosion addition given in *Pt 3, Ch 13, 9.5 Corrosion addition*, the wear allowance, t_w, for shipboard fittings that are not selected from an acceptable National or International standard, is not to be less than 1,0 mm, added to surfaces which are intended to regularly contact the line.

Existing Sections 9 and 10 have been renumbered 11 and 12 respectively.

■ *Section 10*
Anchoring equipment in deep and unsheltered water

10.1 General

10.1.1 It is recommended that the equipment requirements specified in this Section are complied with if the vessel intends to anchor in deep and unsheltered water.

10.1.2 The equipment specified is for ships intended to anchor in water with depth up to 120 m, current with speed up to 1,54 m/s, wind with speed up to 14 m/s and waves with significant height of up to 3 m. The scope of chain cable, being the ratio between the length of chain paid out and water depth, is assumed to be not less than 3 to 4. These requirements are applicable only to ships with a Rule length *L* of not less than 135 m.

10.1.3 The requirements specified in other Sections of this Chapter need to be complied with unless alternative requirements are provided.

10.2 Anchor and chain cable

10.2.1 Anchors and chain cables are to be in accordance with *Table 13.10.1 Anchoring equipment for ships in unsheltered water with depth up to 120 m* and based on the Equipment Number EN_1 obtained from the following equation.

$$\mathrm{EN}_1 = 0{,}628\left[a\left(\frac{\mathrm{EN}}{0{,}628}\right)^{1/2{,}3} + b(1-a)\right]^{2{,}3}$$

where

$a = 1{,}83 \times 10^{-9} \times L^3 + 2{,}09 \times 10^{-6} \times L^2 - 6{,}21 \times 10^{-4} \times L + 0.0866$

$b = 0{,}156 \times L + 8{,}372$

L = Rule length, in metres, *see Pt 3, Ch 1, 6.1 Principal particulars 6.1.1*

EN = Equipment Number calculated in accordance with *Pt 3, Ch 1, 7.1 Calculation of Equipment Number*

10.2.2 The bower anchors are to be connected to their chain cables and positioned on board ready for use.

10.2.3 Anchors are to be of the stockless High Holding Power (HHP) type. The mass of the head of a stockless anchor, including pins and fittings, is to be not less than 60 per cent of the total mass of the anchor.

10.2.4 The mass, per anchor, of bower anchors given in *Table 13.10.1 Anchoring equipment for ships in unsheltered water with depth up to 120 m* is for anchors of equal mass. The mass of individual anchors may vary to 7 per cent of the tabular mass, but the total mass of anchors is not to be less than that specified for anchors of equal mass.

10.2.5 Bower anchors are to be associated with stud link chain cables of special (U2) or extra special (U3) quality. The total length of chain cable, as given in *Table 13.10.1 Anchoring equipment for ships in unsheltered water with depth up to 120 m* is to be approximately divided between the two bower anchors.

10.3 Anchor windlass and chain stopper

10.3.1 The windlass unit prime mover is to be able to supply for at least 30 minutes a continuous duty pull Z_{cont}, in N, given by:

$$Z_{\mathrm{cont}} = 35\,d^2 + 13{,}4\,m_{\mathrm{A}}$$

where

d = chain diameter, in mm, as per *Table 13.10.1 Anchoring equipment for ships in unsheltered water with depth up to 120 m*

m_A = HHP anchor mass, in kg, as per *Table 13.10.1 Anchoring equipment for ships in unsheltered water with depth up to 120 m*

10.3.2 The windlass is to have sufficient power to exert, over a period of at least two minutes, a pull equal to the greater of:

(i) short term pull:

1,5 times the continuous duty pull as defined in *Pt 3, Ch 13, 10.3 Anchor windlass and chain stopper 10.3.1*

(ii) anchor breakout pull:

$$12.18\ m_A + \frac{7{,}0\ L_c\ d^2}{100}\ \mathrm{N}$$

where:

L_c = is the total length of chain cable on board, in metres, as given by *Table 13.10.1 Anchoring equipment for ships in unsheltered water with depth up to 120 m*

m_A = is the mass of HHP bower anchor (kg) as given in *Table 13.10.1 Anchoring equipment for ships in unsheltered water with depth up to 120 m*

d = chain diameter, in mm, as per *Table 13.10.1 Anchoring equipment for ships in unsheltered water with depth up to 120 m*

10.3.3 The capacity of the windlass brake is to be sufficient to stop the anchor and chain cable when paying out the chain cable. Where a chain cable stopper is not fitted, the brake is to produce a torque capable of withstanding a pull equal to 80 per cent of the specified minimum breaking strength of the chain cable without any permanent deformation of strength members and without brake slip. Where a chain cable stopper is fitted, 45 per cent of the breaking strength is to be applied instead.

10.3.4 As far as practicable, for testing purposes the speed of the chain cable during hoisting of the anchor and cable is to be measured over 37,5 m of chain cable and initially with at least 120 m of chain and the anchor submerged and hanging free. The mean speed of the chain cable during hoisting of the anchor from the depth of 120 m to the depth of 82,5 m is to be at least 4,5 m/min.

10.3.5 The chain cable stopper, if fitted, along with its attachments is to be designed to withstand, without any permanent deformation, 80 per cent of the specified minimum breaking strength of the chain cable.

Table 13.10.1 Anchoring equipment for ships in unsheltered water with depth up to 120 m

Equipment Number EN_1		High holding power stockless bower anchors		Stud link chain cable for bower anchors		
Exceeding	Not exceeding	Number	Mass per anchor (kg)	Length (m)	Min. diameter	
					Special quality (Grade U2) (mm)	Extra special quality (Grade U3) (mm)
	1790	2	14150	1017,5	105	84
1790	1930	2	14400	990	105	84
1930	2080	2	14800	990	105	84
2080	2230	2	15200	990	105	84
2230	2380	2	15600	990	105	84
2380	2530	2	16000	990	105	84
2530	2700	2	15900	990	105	84
2700	2870	2	15800	990	105	84
2870	3040	2	15700	990	105	84
3040	3210	2	15600	990	105	84
3210	3400	2	15500	990	105	84
3400	3600	2	15400	990	105	84
3600	3800	2	16600	990	107	87
3800	4000	2	17800	962,5	107	87
4000	4200	2	18900	962,5	111	90
4200	4400	2	20100	962,5	114	92
4400	4600	2	22000	962,5	117	95
4600	4800	2	22400	962,5	120	97
4800	5000	2	23500	962,5	124	99
5000	5200	2	24000	935	127	102
5200	5500	2	24500	907,5	132	107
5500	5800	2	25000	907,5	132	107
5800	6100	2	25500	880	137	111
6100	6500	2	25500	880	142	114
6500	6900	2	26000	852,5	142	117
6900	7400	2	26500	852,5	147	117
7400	7900	2	27000	825	152	122
7900	8400	2	27000	825	-	127
8400	8900	2	27000	797,5	-	127
8900	9400	2	27000	770	-	132
9400	10000	2	27000	770	-	137
10000	10700	2	27000	770	-	142
10700	11500	2	27000	770	-	142
11500	12400	2	29500	770	-	147
12400	13400	2	31500	770	-	152
13400	14600	2	34500	770	-	157
14600		2	38000	770	-	162

Part 4, Chapter 3
Tugs

■ *Section 7*
Towing arrangements

7.2 Towing equipment foundations

7.2.2 ~~The design load for the support structure in way of towing equipment is to be not less than the breaking strength of the towline system. The design load is also to be taken as not less than the breaking strength of the tow hook or the brake holding load, or equivalent, of the winch, whichever is appropriate.~~ The design load to be considered for the strength assessment of the towing equipment and the associated supporting structures is to be as given in *Table 3.7.1 Tug towing equipment design loads*, unless a higher design load is specified by the designer/owner.

Table 3.7.1 Tug towing equipment design loads

Class Notation	Design Force or Bollard Pull as appropriate (kN)	Design Load (kN)
tug protected waters service	$T_{BP} \leq 200$	$2 \cdot T_{BP}$
	$200 < T_{BP} < 800$	$\left(\frac{2600 - T_{BP}}{1200}\right) \cdot T_{BP}$
	$T_{BP} \geq 800$	$1{,}5 \cdot T_{BP}$
tug	$T_{BP} \leq 400$	$2{,}5 \cdot T_{BP}$
	$400 < T_{BP} < 1000$	$\left(\frac{3400 - T_{BP}}{1200}\right) \cdot T_{BP}$
	$T_{BP} \geq 1000$	$2 \cdot T_{BP}$
escort tug protected waters service	$T_{DF} \leq 500$	$2{,}4 \cdot T_{DF}$
	$500 < T_{DF} < 1000$	$\left(\frac{2000 - T_{DF}}{625}\right) \cdot T_{DF}$
	$T_{DF} \geq 1000$	$1{,}6 \cdot T_{DF}$
escort tug	$T_{DF} \leq 500$	$3 \cdot T_{DF}$
	$500 < T_{DF} < 1000$	$\left(\frac{2000 - T_{DF}}{500}\right) \cdot T_{DF}$
	$T_{DF} \geq 1000$	$2 \cdot T_{DF}$
Where T_{BP} = Bollard pull of the tug as submitted by the designer and represents the towline maximum continuous force (also called quasi-static towline force). T_{DF} = Design force as submitted by the designer and represents the towline maximum continuous force for escort operations (also called quasi-static towline force).		
Note 1 The Design loads shown in this table include dynamic effects.		

7.2.3 Scantlings of pillars and pillar bulkheads are to be in accordance with *Pt 4, Ch 1, 4.4 Deck supporting structure.*

~~7.2.4 Scantlings of deck girders and transverses forming the support structure of towing equipment are to be determined by direct calculations using the following stresses:~~

~~τ = 87/k N/mm^2~~
~~σ = 150/k N/mm^2~~
~~σ_e = 213/k N/mm^2~~
~~**where**~~
~~τ = shear stress, in N/mm^2~~
~~σ = bending stress, in N/mm^2~~
~~k = material factor, *see Pt 3, Ch 2, 1.2 Steel*~~
~~σ_e = equivalent stress, in N/mm^2~~
~~$= \sqrt{\sigma 2 + 3\tau 2}$~~

7.2.4 The scantling requirements for towing arrangements are detailed in the following subsections:

- Towing winches *Pt 4, Ch 3, 7.3 Towing winches.*
- Towline guiding fittings *Pt 4, Ch 3, 7.4 Towline guiding fittings.*
- Towing hooks *Pt 4, Ch 3, 7.5 Towing Hooks.*
- Towing equipment supporting structure *Pt 4, Ch 3, 7.6 Supporting structure*

7.3 Towing winches

7.3.1 The scantlings of towing winches (including winch drums, drum shafts, brakes, support frames and connections to the hull strucuture) are to be determined by direct calculations using the Design Loads given in *Pt 4, Ch 3, 7.2 Towing equipment foundations 7.2.2* and are to be able to sustain the following:

- The Design Loads (in the most unfavourable anticipated position of the towline) without permanent deformation i.e. $\sigma_e \leq 1{,}00\sigma_y$.
- The winch BHL (in the most unfavourable anticipated position of the towline), without exceeding $\sigma_e \leq 0{,}80\sigma_y$.
- The anticipated maximum RP (in the most unfavourable anticipated position of the towline), without exceeding $\sigma_e \leq 0{,}40\sigma_y$.

Where

BHL is the brake holding load, i.e. the maximum towline force the towing winch can withstand without slipping of the (activated) brake, considering the towline at the first inner layer.
RP is the rated pull, i.e. the winch maximum hauling-in load considering the towline at the first inner layer.
σ_e = equivalent stress, in N/mm^2
σ_y = specified minimum tensile yield stress of the material, in N/mm^2

7.4 Towline guiding fittings

7.4.1 Towline guiding fittings, such as fairleads, staples, towing pins, stern rollers and equivalent components which guide the towline, shall be able to sustain the force exerted by the towline loaded under a tension equal to the design load as specified in *Table 3.7.1 Tug towing equipment design loads,* in the most unfavourable anticipated position of the towline. The fittings shall not exceed the following permissible stress levels:

- $\sigma \leq 0{,}75\sigma_{ref}$;
- $\tau \leq 0{,}47\sigma_{ref}$;
- $\sigma_e \leq 0{,}85\sigma_{ref}$

Where

σ = normal stress, in N/mm^2
τ = shear stress, in N/mm^2
σ_e = equivalent stress, in N/mm^2
$\sigma_{ref} = = \frac{235}{k_L}$ = Reference stress of the material in N/mm^2, but may be taken as σ_y for fittings not made of welded construction
k_L = as defined in *Table 2.1.1 Values of k_L*

7.4.2 Towline guiding fittings used for guiding the towline when towing on a towing winch shall be able to sustain the force exerted by the towline loaded under a tension equal to the winch BHL (with the most unfavourable anticipated position of the towline) without exceeding the specified permissible stress criteria,

7.4.3 Where a towline guiding fitting has been designed for a specific Safe Working Load (SWL), defined as the maximum static working load, the fitting shall be able to sustain a force equal to 2 times the SWL without exceeding the above-specified permissible stress criteria.

7.5 Towing hooks

7.5.1 The scantlings of towing hooks, their load carrying attachments (transferring load from the hook to the hull structure) are to be determined by direct calculations using the Design Loads given in *Pt 4, Ch 3, 7.2 Towing equipment foundations 7.2.2* and are to be able to sustain the Design Load (in the most unfavourable anticipated position), without exceeding $\sigma_e \leq 0{,}80\sigma_y$.

7.6 Supporting Structure

7.6.1 The scantlings of the supporting structures of towing equipment shall be such that they able to sustain the force exerted upon them with the towing equipment under the action of the towline (with the most unfavourable anticipated position) loaded under a tension equal to the DL as specified in *Table 3.7.1 Tug towing equipment design loads***,** without exceeding the following permissible stress levels:

- $\sigma \leq 0{,}75\sigma_{ref}$;
- $\tau \leq 0{,}47\sigma_{ref}$;
- $\sigma_e \leq 0{,}85\sigma_{ref}$

Where

σ = normal stress, in N/mm^2
τ = shear stress, in N/mm^2
σ_e = equivalent stress, in N/mm^2
$\sigma_{ref} = = \frac{235}{k_L}$ = Reference stress of the material in N/mm^2,
k_L = as defined in *Table 2.1.1 Values of k_L*

7.6.2 In addition, supporting structures of towing equipment used for escort or towing on a winch services shall be such that they able to sustain the force exerted upon them with the towing equipment under the action of the towline (with the most unfavourable anticipated position) loaded under a tension equal to the BHL of the associated winch without exceeding the permissible stress criteria in *Pt 4, Ch 3, 7.6 Supporting structure 7.6.1*.

7.6.3 Where a towline guiding fitting has been designed for a specific Safe Working Load (SWL), defined as the maximum static working load, the supporting structure shall be able to sustain a force equal to 2 times the SWL without exceeding the permissible stress criteria in *Pt 4, Ch 3, 7.6 Supporting structure 7.6.1*.

Part 7, Chapter 11
Arrangements and Equipment for Environmental Protection (ECO Class Notation)

■ *Section 1*
General requirements

1.2 ECO class notation: minimum requirements and additional characters

(Part only shown)

1.2.2 *Pt 7, Ch 11, 3 Supplementary characters* contains additional requirements. Ships complying with these requirements will be eligible for one or more of the following associated supplementary characters, as applicable:

NOx1, NOx2, NOx3 Nitrogen Oxides (NOx) exhaust emissions.

~~**NOISE** Underwater noise from commercial shipping.~~

OW Oily bilge water.

1.4 Definitions

(Part only shown)

1.4.1 The following definitions are applicable:

- **Black water** is the drainage waste from toilets and urinals.
- ~~**Underwater noise**, or the underwater-radiated noise level, refers to noise generated by commercial ships. Underwater-radiated noise level is reported in sound pressure levels in decibels (dB). When it is a ship source, the sound pressure level is adjusted to a level at 1 m from the source.~~
- **Cargo Residues** means the remnants of any cargo which is not covered by other Annexes to MARPOL and which remains on the deck or in holds following loading or unloading, including loading and unloading excess or spillage, whether in wet or dry conditions or entrained in wash water. This does not include cargo dust remaining on the deck after sweeping or dust on the external surfaces of the ship.

1.5 Information to be submitted

(Part only shown)

1.5.5 Information and plans:

(z) Details of self-contained vapour recovery systems, where fitted, required for **VOC-R** character; for tankers carrying crude oil as applicable (*see Pt 7, Ch 11, 2.13 VOC management 2.13.2*); and for **VECS-L** character as applicable (*see Pt 7, Ch 11, 3.18 Vapour emission control systems – VECS-L, VOC-R characters 3.18.3*).

~~(aa) Underwater noise mitigation strategy, including design and operational considerations (supplementary character **NOISE** only).~~

Existing listed items ab and ac have been renumbered aa and ab.

■ *Section 3*
Supplementary characters

~~3.14 Underwater noise from commercial shipping – NOISE character~~

~~3.14.1 For assignment of the NOISE character, compliance with *MEPC.1/Circular.833 – Guidelines for the Reduction Of Underwater Noise From Commercial Shipping to Address Adverse Impacts on Marine Life – (07 April 2014)* is to be demonstrated.~~

~~3.14.2 In order to demonstrate compliance with *MEPC.1/Circular.833 – Guidelines for the Reduction Of Underwater Noise From Commercial Shipping to Address Adverse Impacts on Marine Life – (07 April 2014)*, an underwater noise mitigation strategy is to be prepared, which should consider all primary sources of underwater noise, associated with propellers, hull form, on board machinery and operational conditions which may affect underwater noise. These are to be in accordance with paragraphs 7, 8, 9 and 10 of *MEPC.1/Circular.833 – Guidelines for the Reduction Of Underwater Noise From Commercial Shipping to Address Adverse Impacts on Marine Life – (07 April 2014)*.~~

~~3.14.3 Underwater noise shall be measured, as far as practicable, in accordance with paragraph 6 of *MEPC.1/Circular.833 – Guidelines for the Reduction Of Underwater Noise From Commercial Shipping to Address Adverse Impacts on Marine Life – (07 April 2014)*. Where it is not practicable, alternative proposals will be considered.~~

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